





Albuquerque Urban Development

Enhancing Urban Cooling Interventions by Modeling Urban Forestry through NASA Earth Observations in Albuquerque, New Mexico

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Arizona – Tempe | Summer 2022



Study Area & Period

Study Area

- Albuquerque, New Mexico
- Population: 564,559
- Climate: Subtropical Steppe Climate (BSk)
- Average Summer
 Temperatures: 61° F 93° F

Study Period

- > 2018 2021
- June 1 August 31st



Background: Urban Heat Islands & Mitigation







Project Partners



City of Albuquerque Department of Parks and Recreation



City of Albuquerque Department of Environmental Health



Let's Plant Albuquerque





Community Concerns

- Quality of life
- Heat-related illness and morbidity
- Property values
- Energy use
- Air and water quality
- Stormwater runoff
- Ecosystem services

Project Objectives

- Calculate thermal comfort, microclimate, and a heat mitigation index
- Produce feasibility maps showing micro and macro tree canopy scenarios
- Produce land surface temperature maps
- Create a Standard Operating Procedure for future tree planning and modeling
- Create a brochure to communicate project results effectively to community members
- Create an executive summary for the partners to use in communications with city government members



NASA Satellites & Sensors





Methodology



ISS ECOSTRESS

Data Acquisition

Land Processes Distributed Active Archive Center Catalogue

Processing

Composite raster image created in ArcGIS Pro to map evapotranspiration.

Analysis

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Evapotranspiration data utilized as input in the InVEST Urban Cooling Model.



Landsat 8: TIRS

Data Acquisition

Google Earth Engine: Landsat 8 Level 2 Tier 2 Catalogue

Processing

Values were converted from K to °F and averaged over the study period.

F F

Analysis

Averaged land surface temperatures were added as inputs to the InVEST model.



Urban Heat Exposure Assessment Tool (UHEAT 2.0)





Heat Priority: Summer 2020



InVEST Urban Cooling Model

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Land Cover



Heat Mitigation Index

Shade



Evapotranspiration





InVEST Hack

Land cover averages over the whole city

Land cover averages by census block group









Land Cover

Open Water Developed, Open Space Developed, Low Intensity Developed, Medium Intensity Developed, High Intensity Barren Land (Rock/Sand/Clay) **Deciduous Forest Evergreen Forest** Mixed Forest Shrub/Scrub Grassland/Herbaceous Pasture/Hay **Cultivated Crops** Woody Wetlands **Emergent Herbaceous Wetlands**





Evapotranspiration



ECOSTRESS Instantaneous Values

Composite Image from 2019



Biophysical Table: Current Tree Canopy Cover



- The Nature Conservancy of New Mexico NAIP 2020 Tree Canopy Cover
- > 30m resolution
- Input for 'shade' variable in biophysical table



Biophysical Table: Albedo



- Philadelphia Health & Air Quality, Spring 2020 code
- Landsat 8 surface reflectance
- Input for 'albedo' variable in biophysical table



InVEST Outputs

Current Cooling Capacity Index







InVEST Outputs



Heat Mitigation Index





InVEST Outputs



Estimated Air Temperature



Example Usage: Cooling Capacity





Priority Cooling Region



Multiple Canopy Adaptation Models

ENVI-met



Potential Cooling / Human Thermal Comfort



ENVI-Met: Simulation Locations



True color image of South Broadway Neighborhood

Neighborhood as modeled in ENVI-met



Image credit: Google Earth, team-created image

Cooling Capacity



ENVI-met Model:

- Potential Impacts of Increased Canopy
- Economic Benefits
- Benefits related to priority area (to be defined by project partner)



Errors and Uncertainties



Coarse Spatial Resolution



LST vs. Experienced Temperature



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Estimated Socioeconomic Data

Future Work

Increased Urban Tree Canopy

- Additional Tree Planting Initiatives
- Ecosystem Services
- Public health implications + access to greenspace

Vulnerability in Albuquerque

- Definition of Vulnerability
- Intersectionality of Vulnerabilities
- Environmental Justice
- Collaboration with Community Organizers and University Engagement

ACKNOWLEDGEMENTS

Advisors, Mentors, & Fellows

- > Dr. David Hondula (Arizona State University, City of Phoenix Office of Heat Response and Mitigation)
- Dr. Kenton Ross (NASA Langley Research Center)
- Ryan Hammock (NASA DEVELOP Arizona Tempe)

Project Partners & Collaborators

- > Sean O'Neill (City Forester, City of Albuquerque Department of Parks and Recreation)
- Michelle Gricius (GIS Manager, City of Albuquerque Planning Department)
- Denise Castillo (Sustainability Specialist, City of Albuquerque)

Foundational Project Work

- UHEAT Urban Development PUP Spring 2022 Project (Akshay Agrawal, Vanessa Machuca, Myung Sik Cho, Zainab Farid)
- Yonkers Urban Development II AZ Fall 2021 Project (Tamara Barbakova, Akshay Agrawal, Amanda Trakas, Kyle Pecsok, Lauren Mahoney)

Additional Support

> Akshay Agrawal, Brooke Laird, Muskaan Khemani, Remi Work, Sadie Murray, Monique Howlett

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